

Appl. No. 09/977,069
Amdt. dated September 11, 2003
Reply to Office Action of June 11, 2003

PATENT

REMARKS/ARGUMENTS

This Amendment is responsive to the Office Action mailed on June 11, 2003. No claims are added, canceled, or amended so that claims 1-5, and 12 are canceled and claims 6-11 and 13-19 are pending and subject to examination.

35 USC 103 - Schnur et al., ASM, and Porterfield

Claims 6-8 and 10 are rejected as obvious over Schnur et al., ASM (ASM Handbook Vol. 5, Surface Engineering), and Porterfield (basic textbook on inorganic chemistry).

According to the Examiner, Schnur et al. discloses a semiconductor device comprising a substrate, a thin film including a self-assembled monolayer (SAM), and a metal layer. The Examiner admits that Schnur et al. does not teach the limitation, "for each molecule of the plurality of molecules, the copper in the metal layer is in direct contact with the aromatic group of the molecule." The Examiner states that ASM teaches that copper may be used as a catalyst for electroless plating of copper, and that Porterfield, an inorganic chemistry textbook, teaches that metal complexes with pyridine groups. The Examiner further alleges that:

It would have been obvious for one of ordinary skill in the art, at the time of the invention to use copper as the metal catalyst in Schnur as taught in the ASM Handbook because Schnur is not limited to Pd/Sn catalysts, as at least claim 1 of Schnur makes clear, and because copper is a known catalyst for electroless copper plating, as used in Schnur, as taught by ASM Handbook. In this regard, it has been held that the selection of a known material based upon its suitability for an intended purpose is obvious.

This rejection is traversed.

Schnur et al. and ASM teach away from the proposed modification of Schnur et al.

There is no motivation to modify Schnur et al. with the teachings of ASM, because the cited references explicitly teach away from the modification proposed by the Examiner. Obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so

Appl. No. 09/977,069
Amdt. dated September 11, 2003
Reply to Office Action of June 11, 2003

PATENT

found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988). MPEP § 2143.01. It is improper to combine references where the references teach away from their combination. *In re Grasselli*, 713 F.2d 731, 743, 218 USPQ 769, 779 (Fed. Cir. 1983) (The claimed catalyst which contained both iron and an alkali metal was not suggested by the combination of a reference which taught the interchangeability of antimony and alkali metal with the same beneficial result, combined with a reference expressly excluding antimony from, and adding iron to, a catalyst.). MPEP § 2143.03.

Schnur et al. is directed to selectively depositing microcircuit patterns on a substrate, without etching and without using conventional lithography processing. See, e.g., c. 7, l. 1-7 of Schnur et al. The patterning of fine line conductive paths is clearly an "object" of Schnur et al.'s invention (see c. 5, l. 15 to c. 6, l. 12). The catalyst chosen in Schnur et al. is a palladium-tin colloid (c. 7, l. 63), since this is the most effective catalyst for creating fine microcircuits. As stated at column 9, lines 18-22 of Schnur et al., "[a] principal feature of the invention as schematically indicated at FIG. 3A, is the adherence of the colloidal palladium/tin (Pd/Sn) catalyst precursor to the substrate only in those regions that are to be plated in the electroless bath." (emphasis added.) Page 318 of ASM confirms that palladium-tin colloids are "stable", allow for good selectivity, and is more active per unit of palladium than other catalysts.

The Examiner takes the position that it would have been obvious to substitute the inferior (and likely inoperative for Schnur et al.'s purpose) copper catalyst (specifically a copper-tin colloid catalyst) described in ASM for the palladium-tin colloid catalyst in Schnur et al. Page 318 of ASM states:

A major disadvantage [of using a copper catalyst as opposed to a palladium-tin colloid catalyst] is that because the catalyst is much less active catalytically, the accompanying electroless copper bath must be formulated as a much less stable solution than copper baths employed with the more active palladium-tin catalysts. This can result in process control problems. (emphasis added.)

Contrary to the Examiner's allegation, one skilled in the art would not have chosen ASM's copper-tin colloid catalyst instead of Schnur et al.'s Pd/Sn catalyst, because doing so (1) would

Appl. No. 09/977,069
Amdt. dated September 11, 2003
Reply to Office Action of June 11, 2003

PATENT

be a "major disadvantage," (2) would result in a "much less stable solution," (3) would result in "process control problems," and (4) would take away a "principal feature" of Schnur et al.'s invention. Furthermore, because of the process control problems and poor catalytic ability of ASM's copper-tin colloidal catalyst, the Examiner's proposed substitution of ASM's copper-tin colloidal catalyst for Schnur et al.'s palladium-tin catalyst would also likely not have resulted in the fine microcircuits desired by Schnur et al. Contrary to the Examiner's allegation, the copper-tin colloid catalyst disclosed in ASM would likely not have been "suitable" for Schnur et al.'s intended purpose.

To the extent that the Examiner believes that copper catalysts and palladium catalysts are "functionally equivalent" and therefore obvious to substitute for each other, p. 318 of ASM explicitly suggests that copper and palladium based catalysts are not functionally equivalent, since copper catalysts have a "major disadvantage" compared to palladium catalysts.

It may be the position of the Examiner that with enough time and effort, one "could" make the inferior copper-tin colloid catalyst described in ASM work in Schnur et al.'s process. However, the mere fact that references *can* be combined or modified does not render the resultant combination obvious unless the prior art also suggests the *desirability* of the combination. *In re Mills*, 916 F.2d 680, 16 USPQ2d 1430 (Fed. Cir. 1990). As the Examiner is no doubt aware, "obvious to try" is not standard for establishing obviousness. Rather, one skilled in the art must have been "motivated" to make the proposed modification. As noted above, there is no "motivation" to replace Schnur et al.'s Pd/Sn catalyst with one that has a "major disadvantage."

Applicants also acknowledge the Examiner's allegation that Schnur et al.'s claim 1 is not limited to Pd/Sn catalysts. Applicants submit that the use of the generic use of the word "catalyst" (or variant thereof) in Schnur et al.'s claims does not mean that Schnur et al. contemplated or suggested a copper-tin colloid catalyst that has a "major disadvantage." See, e.g., *Fujikawa v. Wattanasin*, 93 F.3d 1559, 1571, 39 U.S.P.Q.2d (BNA) 1895, 1905 (Fed. Cir. 1996) ("simply describing a large genus of compounds is not sufficient to satisfy the written description requirement as to particular species or sub-genuses").

Appl. No. 09/977,069
Amdt. dated September 11, 2003
Reply to Office Action of June 11, 2003

PATENT

35 USC 103 - Schnur et al., ASM, Porterfield, and Wolf

Claims 9, 11, and 13-19 are rejected as obvious over Schnur et al., ASM, Porterfield, and Wolf. The Examiner states that Schnur et al. does not teach a vapor deposition process. The Examiner states that Wolf teaches that copper metal interconnects can be deposited by a variety of methods including electroplating and vapor deposition methods. According to the Examiner, it would have obvious to have used the vapor deposition processes in Wolf for Schnur et al.'s electroless plating process, because vapor deposition processes are alleged to be "art recognized equivalent means" to the electroplating process used in Schnur et al.

Initially, Applicants submit that the combination of Schnur et al., ASM, and Porterfield is improper for the reasons stated above, and the arguments above are incorporated herein. The additional citation of Wolf does not cure the deficient combination of Schnur et al., ASM, and Porterfield.

In addition, there are a number of reasons why the specific combination of Wolf and Schnur et al. is particular improper.

A vapor deposition process that blankets an entire substrate with metal and a selective electroless deposition process that only deposits metal in selected areas of a substrate are not "art recognized equivalents"

First, the Examiner's allegation that vapor deposition processes are "art recognized equivalent" means to Schnur et al.'s electroless plating process is simply incorrect, because Schnur et al. explicitly indicates that they are not "art recognized equivalents." Schnur et al.'s electroless plating process is a "selective" process whereby metal is "selectively" deposited (see, e.g., c. 9, l. 18-32; c. 10, l. 5-27; and the figures in Schnur et al.). In direct contrast, Schnur et al. goes to great lengths to explain why vapor deposition processes are not part of his invention, because they are used to deposit metal over the "entire area of the substrate" (c. 4, l. 13-22). Clearly, a selective electroless deposition process (as in Schnur et al.) and a vapor deposition process (as described in Wolf) cannot be "art recognized equivalents" since one process deposits metal only on selected areas of a substrate while the other process deposits metal over the entire surface of the substrate. As discussed in Schnur et al., vapor deposition processes require further

Appl. No. 09/977,069
Amdt. dated September 11, 2003
Reply to Office Action of June 11, 2003

PATENT

conventional lithography, etching and development, whereas the selective electroless metal process disclosed in Schnur et al. does not. Schnur et al. not only strongly suggests that selective electroless deposition and vapor deposition are not "art recognized equivalents," Schnur et al. explicitly distinguishes the disclosed selective electroless deposition process from conventional vapor deposition processes. Even Schnur et al., the primary reference cited by the Examiner, makes it abundantly clear that they are not art recognized equivalents. The rejection should be withdrawn for this reason alone.

Modifying Schnur et al. with the teachings of Wolf would have defeated the purpose of Schnur et al.'s invention

Second, Schnur et al. and Wolf teach away from the modification proposed by the Examiner, since the proposed modification would have defeated the purpose of Schnur et al.'s invention. If a proposed modification would render the prior art invention being modified unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification. *In re Gordon*, 733 F.2d 900, 221 USPQ 1125 (Fed. Cir. 1984). MPEP § 2143.01. It is well known that conventional vapor deposition processes that are described in Wolf are performed in expensive deposition chambers that use specialized vacuum control systems. However, contrary to this, the many "objects" of Schnur et al.'s include avoiding the need for complicated or expensive equipment such as vacuum systems (c. 5, l. 48-50), providing a method for making microcircuits using electroless plating (c. 5, l. 38-40), providing a method for plating using non-hazardous aqueous electroless plating solutions (c. 6, l. 7-12), and plating only in selective areas (c. 9, l. 18-22). The proposal to substitute Wolf's vapor deposition process for Schnur et al.'s electroless process would result in a process that would require the use expensive vacuum systems, would not provide for electroless plating, and would not allow for plating in selective areas. There is no motivation to modify Schnur et al. in the manner proposed by the Examiner, since doing so would defeat no less than four "objects" of Schnur et al.'s invention.

Appl. No. 09/977,069
Amdt. dated September 11, 2003
Reply to Office Action of June 11, 2003

PATENT

In addition to defeating 4 or more objects of Schnur et al.'s invention, if one were to substitute Schnur et al.'s selective electroless plating process with a vapor deposition process that coats an "entire" substrate non-selectively (see c. 4, l. 13-22 of Schnur et al.), the entire substrate would be coated with deposited metal and no microcircuits would be formed. **Should the Examiner maintain that it is "obvious" to create a selectively deposited metal pattern like Schnur et al.'s (i.e., without lithography and etching) using a vapor deposition process that coats an entire substrate, Applicants request an explanation as to how this might be done as it is not apparent from the cited prior art.**

In sum, it is clear that there is no motivation to modify Schnur et al. in the manner proposed by the Examiner because (1) no less than four objects of the invention would not be satisfied, and (2) the microcircuits desired by Schnur et al. would not even be formed by the proposed modification.

Lastly, to the extent that the Examiner might allege that the "vapor deposition" limitation in claim 13 does not have patentable weight, because it is process limitation (using established product-by-process case law), Applicants submit herewith an article by Yin et al. (Mater. Phys. Mech. 4 (2001) 56-61) to show that there are non-obvious structural differences in a layer deposited by electroless plating (see page 56) and by a vapor deposition process. As shown by FIG. 3 of Yin et al., SEM micrograph c) shows a film formed by vapor deposition, whereas SEM a) shows a film formed by an electroless plating process. As shown, the deposited films have a distinct structural difference, and as noted by page 58, second column of Yin et al., "the vapor phase deposition seemed to show a rougher surface as compared to other processes." Therefore, it cannot be presumed the resulting vapor deposited layer would be the same as or obvious over the electroless metal layers described in Schnur et al.

All obviousness rejections

Improper hindsight was used to combine the cited references

Each of the pending obviousness rejections is based on improper hindsight, because the skilled artisan would not have modified Schnur et al. as proposed by the Examiner, unless the

Appl. No. 09/977,069
Amdt. dated September 11, 2003
Reply to Office Action of June 11, 2003

PATENT

skilled artisan had the benefit of Applicants' disclosure first. For example, with respect to independent claim 13 and dependents, it would not have been "obvious" to the person of skill in the art at the time of the invention to (1) read Schnur et al., (2) look to ASM to pick an inferior copper catalyst that has a "major disadvantage, is "much less active catalytically," and results in unstable baths and "process control problems", and then (3) substitute Wolf's vapor deposition process for Schnur et al.'s selective electroless deposition process even though the use of vapor deposition in Schnur et al. would (a) defeat no less than four objects of Schnur et al.'s invention and (b) would not create the selectively patterned microcircuits desired by Schnur et al. In other words, one looking at only the prior art, and not Applicants disclosure, would not have combined the cited references in the way that the Examiner has proposed. The only place of record that discloses all claim elements and provides logical reasons for combining all claim elements is Applicants' disclosure, and not the prior art. Since the obviousness rejections were based on improper hindsight, the obviousness rejections are improper.

The claims and prior art have not been considered "as a whole" as required by § 103

In view of the numerous reasons explicitly provided by the cited prior art not to modify Schnur et al. as proposed by the Examiner, it may be the position of the Examiner that obviousness can be established by ignoring passages of the prior art references that teach away from their combination, while only acknowledging teachings in the prior art which could allegedly support a finding of obviousness. If this is the position of the Examiner, it is contrary to both the established rules of the MPEP and the law of the Court of Appeals for the Federal Circuit. A prior art reference must be considered in its entirety, i.e., as a whole, *including portions that would lead away from the claimed invention. W.L. Gore & Associates, Inc. v. Garlock, Inc.*, 721 F.2d 1540, 220 USPQ 303 (Fed. Cir. 1983), cert. denied, 469 U.S. 851 (1984). MPEP § 2143.01. Here, although the Office Action is 10 pages long, it does not even once address or even consider the numerous statements in the cited prior art which teach away from the proposed combination, but ignores them. Applicants can only presume that the references

Appl. No. 09/977,069
Amdt. dated September 11, 2003
Reply to Office Action of June 11, 2003

PATENT

have not been considered "as a whole" as required by § 103 and that the obviousness rejection is improper. Accordingly, the obviousness rejections should be withdrawn.

CONCLUSION

In view of the foregoing, Applicants believe all claims now pending in this Application are in condition for allowance. The issuance of a formal Notice of Allowance at an early date is respectfully requested.

If the Examiner believes a telephone conference would expedite prosecution of this application, please telephone the undersigned at 415-576-0200.

Respectfully submitted,



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